IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

#12

In re Application of:	
Basford, William C.	Patent Examiner: Patel, Kiran B.
Filing Date: June 8, 2001	
Serial No.: 09/877,585	ART UNIT: 3612
For:	
APPARATUS TO REDUCE BASE DRAG BEHIND BLUFF BODIES (as amended)	March 20 , 2003 Hallowell, Maine 04347

DECLARATION UNDER 37 CFR SECTION 1.132

Honorable Commissioner of
Patents and Trademarks
Washington, D.D. 20231

Dear Sir:

I, WILLIAM C. BASFORD, do hereby declare and state that:

1. I am a citizen of the United States of America, having an address at 17 River Road, Benton, Maine 04901.

2. I filed my own above-titled patent application, and had telephone conferences with Examiner Kiran Patel, in which I provisionally elected for initial consideration, the embodiment of Figure 8 and claims 5 through 10 and 13. I understand, as a provisional matter, that the Patent Office has withdrawn Figures 9 through 13. Moreover, claims which did not read on Figure 8 have been withdrawn from further consideration. I am informed that allowance of a generic or linking claim will remove the withdrawal of claims 1 - 4, 11 - 12 and 14 - 18.

3. I subsequently received, from Examiner Patel, an Official Action, dated September 24, 2002, concerning the merits of my invention. In that Official Action, at paragraph 4, Examiner Patel advised me to obtain the services of a Registered Patent

Attorney to prosecute the application. I have followed his advice by selecting Stanley R. Jones, Esq., Registration No: 22,659. I have given Mr. Jones Power of Attorney, submitted herewith, and Mr. Jones has assisted me in the preparation of the accompanying Amendment and this Declaration.

4. With the assistance of Mr. Jones, I have read and reviewed the Examiner's rejection and have sought to overcome that rejection by:

amending the application to a proper format;
distinguishing my claimed invention from the cited prior art;
submitting, for the Examiner's consideration, generic claims;
clarifying the definitions of my invention; and
improving the form and presentation of my invention.

5. My education includes a Bachelor of Science degree in Mechanical Engineering from a fully accredited engineering school, with coursework including two semesters of Physics, two semesters of Thermodynamics, and one semester of Fluid Mechanics.

6. My work experience includes about eight to ten years in Energy Management, mostly in commercial and industrial buildings, and most recently with Green Mountain Power Corporation in Montpelier, Vermont. I am a licensed Professional Engineer (P.E.) and have been so licensed from 1982, by satisfying the standard NCEE written examination. I hold and maintain current Professional Engineer licenses in the States of Maine (License No.: 6179) and Vermont (License No.: 4149).

7. During the process of developing my invention, I developed a simple and low cost testing approach for measuring aerodynamic drag. My approach used a roughly one quarter scale test model built from plywood and carried on top of a highway vehicle. A force scale was readable from within the moving vehicle in order to determine the drag reduction of various models which I tested. Thus, my low cost testing approach represented a simplified version of a full scale wind tunnel. While not providing the test precision sought by some academic researchers, my approach has proven to be highly effective for the comparison testing used for developing and optimizing my invention.

8. I acknowledge that both vortex generators and boattail plates were known in the art prior to my invention and I have so stated in my patent application. My invention differs from such art and may be summarized as a new and novel combination of vortex generators together with shortened boattail plates at the rear of bluff bodies, with the size and positioning of the boattail plates providing greater base drag reduction, while reducing the optimum length or rearward extension of the boattail plates.

9. By using vortex generators and boattail plates in combination, the base drag reduction shown by my testing method was increased to about 50% greater than that provided by full length boattail plates when used alone, while the optimum rearward extension, or length, of the boattail plates is reduced by about half. Either of these two benefits would, by itself, prove the value of this, my combination invention. Obtaining 50% greater drag reduction while simultaneously reducing the optimum plate length by over half, is clearly a significant advance in drag reduction, that was not foreseen by others working in the drag reduction field.

10. Rather than being just an academic curiosity, my invention - if adopted Nationwide - would cause enormous savings to the long haul trucking industry. For example, long haul trucks consume over 16 Billion gallons of Diesel fuel per year in the U.S. Reducing the total aerodynamic drag of these trucks by about 15% will yield about 10% in fuel savings. If this invention achieves widespread use on long haul trucks, the potential fuel savings is well over one Billion gallons per year, with corresponding air pollution savings. At current Diesel fuel prices of $2 per gallon, as of mid March 2003, the potential fuel cost savings is over $2 Billion per year for the trucking industry alone.

11. The Official Action, in paragraph 9, rejected my claimed invention; and asserted that my invention was not patentable over United States patent Switlik 5,498,059 ('059) in view of Wheeler 5,058,837 ('837). I have carefully studied these two reference patents and have given considerable attention to the Examiner's proposed combination of the disclosures of same.

According to the Examiner, in paragraph 9, it would have been:

obvious to one having ordinary skill in the art at the time the invention was made to modify the device as disclosed by Switlik '509, to include a plurality of vortex generators, as disclosed by Wheeler '837 to achieve the desired level of base drag

reduction for the bluff body. It is my technical opinion that these references lack any instructions that would direct one of ordinary skill toward my invention. I have reviewed a significant number of prior art references in my patent application and none of them disclose the shortened boattail plates and unique results of my invention, as claimed.

12. For example, I have now submitted a new claim 35 which is generic to all of my various embodiments shown in my Figures. Thus, in my accompanying amendment I have stated in claim 35 that I have, for the first time ever, invented :

Apparatus for reducing to a minimum the fluid-dynamic base drag of a bluff body moving through a fluid passing generally along said bluff body and creating, at the rear of the body, separated shear surfaces which define, a low pressure wake having an outer wake perimeter, which bluff body has a substantially flat rear base surface with given height and width dimensions and a periphery of trailing edges, said apparatus comprising:

vortex generator means mounted adjacent to and forward of said trailing edges for generating counter-rotating stream-wise vortices in said fluid layer, which generators cause the separated shear surfaces to turned sharply inward thereby reducing the size of the low pressure wake, and

edge means coupled to said base surface and inset from said trailing edges for intercepting said separated shear surfaces at the outer perimeter of said low pressure wake, namely, at a distance behind said base surface of about 1/6th to 1/8th of said given height or width dimension, whichever is less.

13. The V shaped low drag vortex generators disclosed in Wheeler '837, while clearly superior to previous designs for vortex generators, still provide only limited base drag reduction. But when an edge - such as that of my trailing panel or my shortened boattail plate - is used in combination with Wheeler-type vortex generators, as first disclosed only in my patent application, far greater base drag reduction is achieved. This stated positioning of the edge is critical to my invention.

14. Full length boattail plates, as disclosed in US Patent 4,682,808 to Bilanin, reportedly provide about 10% net drag reduction, when used on a typical full sized tractor and semi-trailer truck. However, because of their optimum length of 40 inches or more when used on a full sized tractor and semi-trailer truck, they conflict with current Department Of Transportation (DOT) regulations on allowable extension beyond trailer underride bars. In contrast, my combination invention provides roughly 50% greater

base drag reduction with an optimum plate length of only 18 inches. Even when the length of the plates must be reduced to 12 inches, for use on trailers built after January, 1998, my combination invention still provides greater base drag reduction than Bilanin's full length boattail plates when used alone.

15. US Patent 5,498,059 to Switlik, cited by the Examiner, shows boattail plates in several of his Figures. Such Switlik plates, in my opinion, simply follow the Bilanin '808 approach. As best understood, Switlik '059 discloses an improved way to more easily fold and unfold the boattail plates to allow access to the rear doors of a truck body. Switlik '059 provides no additional base drag reduction over Bilanin '808, and does not suggest any reduction of the optimum length of the boattail plates. Switlik '059 does not teach or suggest that vortex generators can be used in combination with shortened boattail plates to provide greater base drag reduction.

16. Extensive searching of the available literature has revealed several statements which, it is my opinion, lead me to conclude that the body of known prior art goes away from my invention. It would extend this Declaration far too long if I specifically discussed all of these references. (And most of them are already dealt with in my application.) Let me summarize, however, by saying that the drag reducing value of vortex generators has often been dismissed by others in the field. Sighard Hoerner stated on page 3-26 in his 1958 book Fluid-dynamic Drag:

> With regard to drag, an equal price has to be paid, however, for avoiding separation in the form of momentum losses in the outer air stream.

US Patent 5,058,945 to Elliot, et al, which shows the use of vortex generators with an inflatable truncated boattail, stated only that vortex generators could be used "to maintain attached flow over the bag" but showed no recognition that the addition of vortex generators could provide greater drag reduction, or provide the same base drag reduction with a shorter bag.

W. A. Mair of Cambridge University considered a combination using vortex generators with full or truncated boattails in the 1960s, but found that it provided little or no additional drag reduction, over the best boattail shapes when used alone. Mair was also reported to have tried using vortex generators in combination with a trailing disc to reduce the base drag of a small axisymetric bluff body, but found no beneficial results.

To the contrary, it was reported that he tested the combination in a wind tunnel and found no additional base drag reduction. Apparently, Mair did not recognize that the trailing disc would need to be moved much closer to the base surface in order to obtain greater base drag reduction.

Furthermore, Mair's test model had very low forebody and skin friction drag, and produced a thin and sharply defined separated shear surface, which made the trailing disc very sensitive to mounting distance. He would have had to find just the right mounting distance to get the desired greater base drag reduction.

U. S. Patent 5,348,366 to Baker, et al., based on a simple trailing panel, does not teach or suggest that the base drag could be further reduced, or the mounting distance of the trailing panel decreased, by the addition of vortex generators. In fact, U. S. Patent 5,058,837 to Wheeler for Low Drag Vortex Generators was not listed among the references in the Baker patent. In similar fashion, U. S. Patent 4,682,808 to Bilanin, which disclosed so called boattail plates, does not teach or suggest that base drag could be further reduced, or the length of the boattail plates decreased, by the addition of vortex generators. Here again, Wheeler '837 was not listed among the references.

An extensive literature search revealed no awareness that vortex generators can be used in combination with boattail plates to achieve greater base drag reduction. Even the ongoing research effort led by Lawrence Livermore National Labs, despite a research budget of over $5 Million, has not discovered the value of this combination. In at least two of their electronic publications, available on the research team's website, vortex generators and boattail plates were mentioned on the same page, but to date they have shown no awareness that the two methods can be used in combination to provide greater base drag reduction with shorter boattail plates.

17. I have considered the prior art proposed in the Office Action and discussed in my application. Nowhere in such prior art combinations do I find the disclosures that would normally lead one of ordinary skill in the drag reduction field to my invention. The combination proposed by the Examiner, in my opinion leads away rather than toward my invention. For these reasons I urge that the Examiner may want to reconsider his bases for the rejection.

18. All statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true; and further, these statements are made with knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both or under §1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of the application for any patent issuing thereon.

Dated: March 19, 2003

By: William C. Basford

William C. Basford